REPORT

Snowden

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OF

B. AYCRIGG, PRINCIPAL ENGINEER,

APPOINTED TO EXPLORE

THE COUNTRY BETWEEN THE WEST BRANCH IMPROVEMENTS

AND THE TOWN OF

FRANKLIN, ON THE ALLEGHENY RIVER.

READ DECEMBER 15, 1836.

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REPORT, &c.

CANAL COMMISSIONERS' ROOM,
December 15, 1836.

His Excellency, JOSEPH RITNER,
Governor of Pennsylvania.

SIR:—By direction of the board, I transmit to you the report of B. Aycrigg, principal engineer appointed to explore the country between the West Branch improvements and the town of Franklin, on the Allegheny river.

Very respectfully,
MOSES SULLIVAN, *President.*

Harrisburg, Dec. 13, 1836.

To MOSES SULLIVAN, ESQ.
President of the Board of Canal Commissioners of Pennsylvania.

SIR—We arrived at this place on the morning of the 11th inst. having examined the dividing ridge and completed a connected line from the mouth of Red Bank on the Allegheny to the mouth of the Sinnemahoning, on the West Branch, a distance of one hundred and twenty-eight and one-fourth miles, and taken the requisite notes for a detailed estimate accompanied by a topographical map of the country included in the examination.

No examination was made on the Allegheny since it had been already three times levelled, and the expense of different plans of improvement reported. The length of the time during which we could work, being limited, that part was preferred, of which least was known and therefore having reached the Allegheny, we returned to the summit and proceeded eastward, in order if possible to connect our line with the head of the improvements on the West Branch. This, however, we found impracticable, since the river freezing, precluded the possibility of our being accompanied by our tents and camp equip-

age in a country without roads, where our only means of transportation was by water.

The levels and survey having been taken with the same precision as in the preliminary examinations, for a work whose construction was authorized by law, it will require several weeks to prepare an estimate, and in the mean time the following general view of the subject is respectfully submitted to the board.

Having obtained all the information that was available from the official reports of former examinations, and from individuals who were acquainted with the country to be explored; the greatest reliance was placed upon the account given to me personally, by William Wilson, Esq. having called on him for this purpose, at his residence in Williamsport.

From his examination, he had formed the opinion, that if a water communication could be at all effected, it must be by connecting the waters of Bennett's branch of the Sinnemahoning with those of Sandy Lick, and from his description of the ground, together with his notes of the levels, the conclusion was formed, that although other routes might be practicable, from resources that had been overlooked from the circumstance of their not being obvious, or not observed in a country, the greater part of which is a wilderness, this at least possessed the greatest facilities as far as ascertained. However, to leave nothing uncertain, a crest line was commenced ten miles south of the Franklin turnpike, at a depression in the dividing ridge, between the waters of the Mahoning and Woodside's run, mentioned in Mr. Mitchell's report of 1827, as the 'Clover patch,' and thence northwardly along the ridge between the heads of the Mahoning and Sandy Lick on the west, and Curry's run, Anderson's creek and Bennett's branch of the Sinnemahoning, tributaries of the West Branch on the east.

From this examination, it was ascertained that the summit reported by Mr. Wilson, between Bennett's branch and Sandy Lick, is the lowest in this range of country, being one hundred and twenty-seven feet lower than the lowest of those between Sandy Lick and Anderson's creek, three hundred and eighty lower than any between Anderson's creek and the Mahoning, three hundred and sixty-seven below the Mahoning and Curry's run, and four hundred and fifty-five below the Clover Patch.

The height of all the depressions between the Clover Patch and Boon's mountain, having been thus settled, and Mr. Wilson having previously found that the summit of Elk and West creeks, between the Driftwood and Clarion, and the lowest north of Boon's mountain, was one hundred and eighty feet above the one proposed; the examination was next made to ascertain the amount of water that could be commanded on the summit level at the height proposed by Mr. Wilson, or two hundred feet below the crest of the depression, and from this it was found that the drainage on the eastern side of the ridge would be collected from twenty square miles, and on the wes-

tern side a fraction over eighty square miles. The different streams mentioned by Mr. Wilson, were not guaged separately since their minimum flow is a matter of no importance, according to the present proposed plan of improvement; but Sandy Lick below the forks of Fall's creek, and containing the water of all these runs together, was guaged during the dry weather and found to yield the insignificant amount of three hundred and seventy-five cubic feet per minute.

This has hitherto been considered an insurmountable difficulty; but when the proper view is taken, proves to be one of the most favorable circumstances connected with the subject, and requires elucidation for those who are not familiar with the Western section of the state, or perhaps have never reflected upon its bearing on the subject under consideration.

The geological structure of the country west of the Allegheny mountain, and consequently on the proposed summit, differs materially from that on the eastern side. The rocks lie in horizontal strata, and are principally graywacke-slate, and clay-slate, accompanied by bituminous coal and clay, the three latter almost impervious to water; and hence we find on the summit of narrow ridges, and in dry weather, muddy roads and swampy ground. The service of the country, also presents peculiar features. Although, there is at present, scarcely a piece of high level ground to be found, still the whole of this country must have been originally a rolling table land with innumerable rills, which in the course of ages have worn out deep ravines, leaving the summits of the ridges almost sharp, and the whole together forming what might almost be compared to the roofs of a large irregular city with their water tight surfaces, discharging the water immediately into the gutters below, and these into the drains, by means of which it is soon carried off, so that in a short time after a rain, hardly a vestage of it remains.

This peculiarity of the western streams, rising rapidly and as suddenly falling, may be aptly illustrated by an example.

As before observed, the flow of Sandy Lick below the mouth of Falls creek, was but 375 cubic feet per minute. On the 10th of September when at a short distance below this place, but without any intervening stream of importance, we had a thunder storm in the afternoon and night, and found the water on the next day flowing at the rate of 21,437 cubic feet per minute; and again in two days reduced to 2,371 cubic feet per minute.

Could the water find its way into the earth as it does in the eastern section of the state, or on Boon's mountain, or if retained by land comparatively level, the streams would neither rise nor fall so rapidly, and being fed by springs from these natural reservoirs, would present a more imposing appearance in a dry season; but at the same time the total amount discharged by the streams, would be less in proportion to the water retained over an extended surface, and consequently exposed to evaporation in a much greater degree, than in a

comparatively dry country. If there was no basin that could by artificial means be converted into a reservoir, capable of containing the water, we should lose the benefit of nearly all the floods; but in this respect, the valley of Sandy Lick creek is remarkably favorable; since even in this elevated region, a mound of three-eighths of a mile and extreme height of forty feet, will give us a reservoir of three square miles, with a useful depth of twenty feet. This reservoir will at the depth of twenty feet, contain 1,672,704,000 cubic feet of water. A lock proposed to be fifteen by nineteen feet, and lift near the summit five feet, will contain 6,750 cubic feet. Suppose it practicable to pass a boat every three minutes, and that every three boats will on an average require two locks full of water at each end of the summit. (though in a crowded trade such as we are now considering, it would approach nearly to one lock full for two boats.) This would require one lock full every two and a fourth minutes, or 156,600 locks full in two hundred and forty days to pass 115,200 boats, requiring for lockage 1,036,800 cubic feet per annum. Allow fourteen miles to be constantly supplied from the summit at the rate of fifty cubic feet per mile per minute for wastage, and the loss would be 241,920,000 cubic feet per annum, which added to the lockage water, makes 1,278,720,000 cubic feet per annum, and leaves a surplus of 493,894,000 cubic feet, or nearly one-fourth of the whole, after allowing the boats to pass the locks more rapidly, and the lockage and wastage water to be greater than will be the case, unless the canal should be supplied with double locks.

This calculation is made from the reservoir once full. But supposing the trade to continue eight months, and the rain to fall and be drawn off regularly, the amount used might be three times the full of the reservoir, and consequently its extent would be amply sufficient.

The rain and snow that have fallen in Lebanon during the last seven years, have averaged 40.46 inches, the least being 34.49, and greatest 44.78. But nine inches on an area of eighty miles is sufficient to fill the proposed reservoir, and consequently, if we obtain twenty-six per cent of the smallest amount that has fallen at Lebanon during the last seven years, (and the opinion appears to be general, and perhaps well founded, that there is more rain on the summit than in a lower and more level country,) we shall, with the most active trade, have a surplus of one fourth of the whole amount. But from several years intimate knowledge of the large reservoir on the Union canal, and the country that supplies it with water, and a comparison of the same with the district under consideration, I should anticipate the probable amount collected at two-thirds or perhaps three-fourths of all that falls.

However, should this not be considered sufficient, we can command the water from twenty additional square miles on the eastern side of ridge, and being sensible of the prevailing opinion, that a water communication was impracticable, it was thought best to reduce to a cer-

tainty the whole of the available resources of the summit, and a level carried over the dividing ridge to Little Toby, from this it was found that by elevating the water one hundred and twenty feet, the whole of Little Toby could be thrown into the summit. The natural flow of this stream, would of itself be sufficient to support an active trade, and by reservoirs the supply increased to any desirable extent. But this I consider, altogether unnecessary, and the examination was merely made to remove all doubts from the minds of those who have to decide the question.

The summit level, including the tunnel and reservoir, being unusual in its arrangement, it may not be improper at the present time to give a description of the plan proposed to suit the exigencies of the case.

It is proposed to construct a canal on a level with the tunnel, (which will not vary materially from one and a fourth miles in length,) having all the usual arrangements for feeding from the natural flow of the streams, in the same manner as if there was to be no reservoir occupying the same ground, with the exception of having a high tow-path on the hill side, and the outer bank protected from washing by a stone covering. This being completed, a dam is thrown across the lower end of the valley, raising the water over the whole of this work, so that in high water nothing would be seen except a large artificial lake with a tow path skirting its margin and locks at each end. The water would be retained in this position by four locks placed near the tunnel and four of similar construction at the dam, all having their bottoms on the same level, and consequently those nearest the reservoir might be used for locks of twenty feet lift, and the others successively fifteen, ten and five feet lift. According to this arrangement the boats passing through the tunnel will lock up into the reservoir through the four locks, each raising it five feet in the same manner, as if they were ordinary lift locks with no extra depth of water, and, consequently the expense in each instance is equal to that of a five feet lock, (the proposed lift of the locks between the summit and the next supply of water.) As the summit is drawn down, the lift of the first lock is reduced, until at five feet from a full height the gates of the first lock are thrown open, in the same manner as those of a guard lock, after the flood has subsided, and the boats pass through without obstruction. The next five feet throws another pair of locks open, and so on successively for the third and fourth pair, when the reservoir will be shut out from all connexion with the canal, which will now receive the water from the natural flow of the runs and from lateral reservoirs, should such be found necessary. In case of floods, the surplus water would pass under the canal and deposite its sediment into the body of the reservoir, and as the waters rise successively the locks would come into use, until the reservoir was full, and the surplus water pass off over a waste wier in the dam.

The distance from the dam, at the western end of the reservoir to the Allegheny, (pursuing the proposed line and cutting off by deep

cuts and short tunnels 9.10 miles, from the united lengths of Sandy Lick and Red Bank,) will be sixty-five and one half miles and descent five hundred and eight-two feet. The distance from the same point, to the West Branch at the mouth of the Sinnemahoning, will be sixty-two and three-fourth miles, and lockage seven hundred and three feet, effected on the West by eighty-three locks, and on the East by one hundred.

To the question, whether there may not be some other route as good or better, than the one proposed? I answer that I think not.

For the first three months, I was constantly in advance of the party, that no point might be omitted which presented the least probability of being important; and of all such, an accurate examination was made with the instruments, a detail of these would however, be of no interest except to persons in the vicinity. Accompanied by a woodsman as guide, and a security in case of accident in the wilderness, I have traversed the whole country on foot, headed the streams, examined the valleys, and believe that I have a thorough knowledge of all that is important to the present question, from the Clover Patch, on the south, as far north as the summit between the Driftwood, and the Clarion, and consider the proposed route, the one distinctly pointed out by nature, as the main channel of communication between the east and west. South of this there is nothing worthy of notice, by way of comparison. The summits are higher, and supply of water deficient; while on the north, the summit of Elk and West creeks, which alone is worthy of notice, is one hundred and eighty feet higher, the supply of water, at least doubtful, and the expense of construction far greater, as the Clarion is subject to much higher freshets than Sandy Lick, and Red Bank, and consequently requires the construction of very heavy embankments in the bed of the river; since, according to notes taken from point to point, during a reconnoisance, made for the purpose of ascertaining its character, I found about two-thirds of the distance from the town of Ridgeway, to the mouth of the Clarion, or sixty-six out of one hundred miles, to be steep bluff, while Sandy Lick shows the reverse of this, or two-thirds of flats. For slack water it is less favorable, as it is larger and as before observed, subject to higher freshets, and the rapid descent of either stream, would make a continuous slack water very expensive, from the great number of dams required. The distance by the two routes, is so nearly the same, that by the course of the streams the Red Bank route would be about four miles longer, but by the line, five miles shorter than the natural course of the Clarion, when taken between the mouth of the Sinnemahoning, and the connexion of the two routes, at the mouth of the Clarion; twenty-two miles of the middle, or Sandy and Red Bank routes being on the Allegheny, and therefore, so much toward the improvement of that river. But when considered with reference to the distance to Pittsburg, the mouth of Red Bank, is twenty-two miles nearer, than the mouth of the Clarion, and an additional thirty-six miles below Red Bank, along the Alle-

gheny, would complete the connexion to Pittsburg, and therefore open the way not only from Pittsburg and Franklin, to the east, but likewise between these two places. From all these circumstances, I was left in no doubt as to the proper position for the line, and therefore made a minute examination of the one already described.

Having commenced the examination with a full determination of not taking the responsibility of recommending the construction of a canal, unless I could command on the summit, double the amount of water that a close calculation would show to be necessary, and this beyond a doubt, but in such a case to report the facts and leave others to draw their own conclusions, without my expressing an opinion, it gives me great satisfaction to state, that my most sanguine anticipations have been more than realized, and the problem which possessed double interest from the importance and supposed impracticability of the work, has been fully solved in my own mind, and that an improvement which before the examination, I considered a bare possibility, is now almost reduced to a certainty, and I confidently look forward to the period when large boats will leave the wharf at Philadelphia, and deposite their cargoes at Pittsburg, or lake Erie. It may not be in one, two or ten years, but that every avenue to the west will be crowded, and the remarkable facilities here presented, will be one day improved, is a subject upon which I have no doubts. Although the existing prejudice against reservoirs, for the supply of water, may for a while retard the work; this will gradually wear off, the canal be constructed, support an active trade, make the West Branch canal a good investment, and be used as an example to convince others, that improvements which at first sight appear impracticable, may nevertheless be effected, and the country at large receive the benefit of a thorough water communication from the east to the west.

All of which is respectfully submitted,

B. AYCRIGG,

Principal Engineer, appointed to explore the country between the head of the West Branch improvements, and the town of Franklin on the Allegheny.